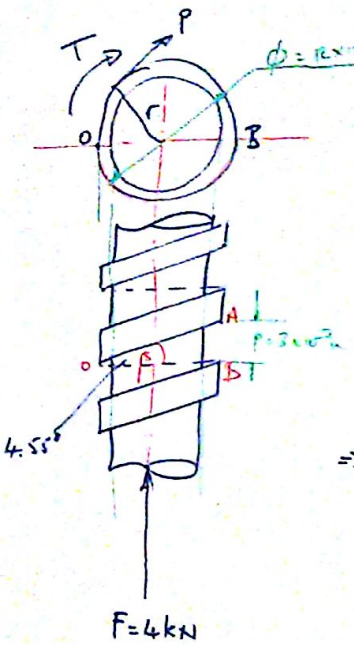


$\mu = 0.2$

Friction Angle. = β say.

OB. circumference (outer surface)

$= 2\pi r = 2\pi\left(\frac{d}{2}\right)$

$\therefore OB = \pi d$

$\Rightarrow \tan\beta = \frac{AB}{OB} = \frac{p}{\pi d}$

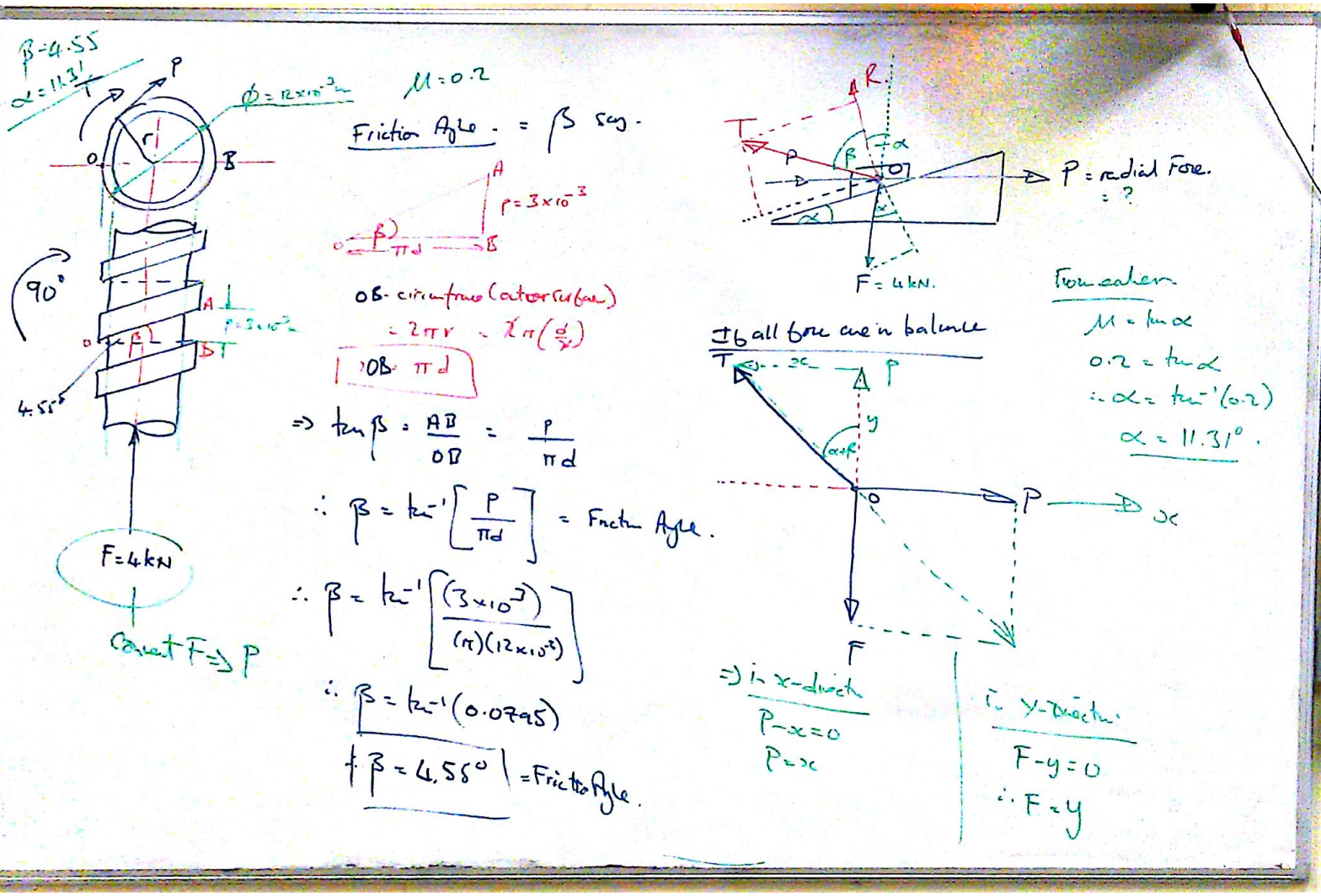
$\therefore \beta = \tan^{-1}\left[\frac{p}{\pi d}\right]$ = Fricton Agle.

$\therefore \beta = \tan^{-1}\left[\frac{(3\times10^{-3})}{(\pi)(12\times10^{-3})}\right]$

$\therefore \beta = \tan^{-1}(0.0795)$

$\therefore \beta = 4.55°$ = Friction Agle.

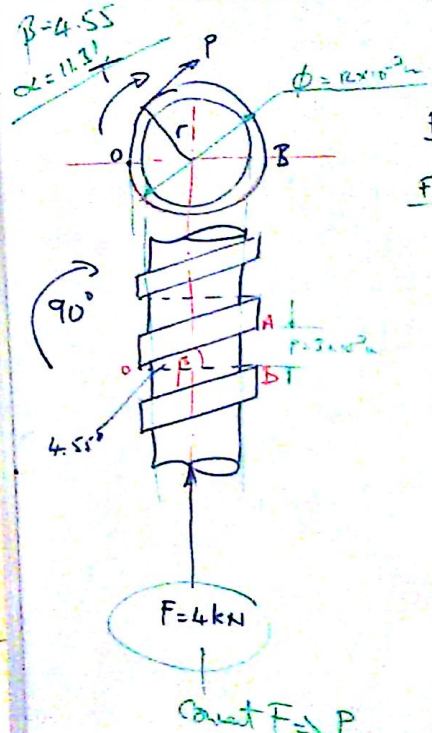
Scanned by CamScanner



Scanned by CamScanner

$\beta = 4.55$

$\alpha = 11.31°$



Coeff $F \Rightarrow P$

$\mu = 0.2$

Friction Angle = β say.

From ①

$\sin(\alpha+\beta) = \frac{x}{T}$

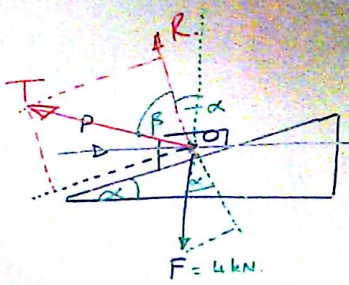
$\cos(\alpha+\beta) = \frac{y}{T}$

$\tan(\alpha+\beta) = \frac{\sin(\alpha+\beta)}{\cos(\alpha+\beta)}$

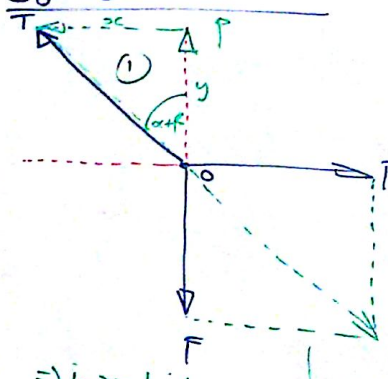
$= \frac{\left(\frac{x}{T}\right)}{\left(\frac{y}{T}\right)} = \frac{x}{T} \cdot \frac{T}{y}$

$\boxed{\tan(\alpha+\beta) = \frac{x}{y}}$

∴



If all four are in balance



$\Rightarrow$ i.e. x-direction

$P - x = 0$

$P = x$

i.e. y-direction

$F - y = 0$

$\therefore F = y$

From above

$\mu = \tan\alpha$

$0.2 = \tan\alpha$

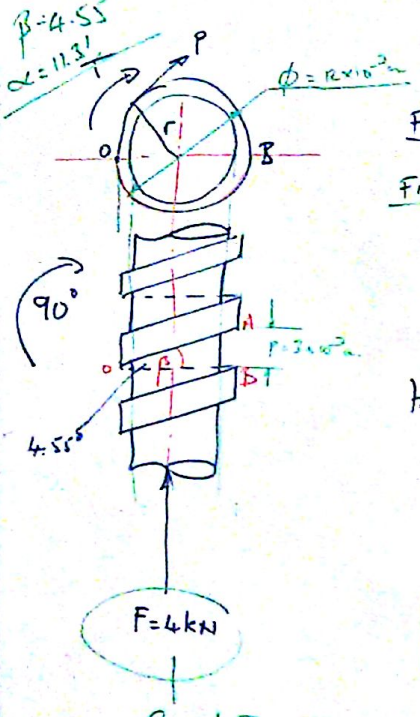
$\therefore \alpha = \tan^{-1}(0.2)$

$\alpha = 11.31°$.

Scanned by CamScanner

$\beta = 4.55$

$\alpha = 11.31$



Consider $F \Rightarrow P$

$P = 4000 \tan(15.86)$

$\therefore P = 4000 (0.28)$

$P = 1120\ N$

$\mu = 0.2$

Friction Angle = β say.

From Δ ①

$\sin(\alpha+\beta) = \frac{x}{T}$

$\cos(\alpha+\beta) = \frac{y}{T}$

$\tan(\alpha+\beta) = \frac{\sin(\alpha+\beta)}{\cos(\alpha+\beta)}$

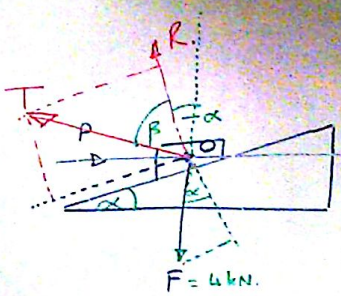
$= \frac{\left(\frac{x}{T}\right)}{\left(\frac{y}{T}\right)} = \frac{x}{T} \cdot \frac{T}{y}$

$\tan(\alpha+\beta) = \frac{x}{y}$.

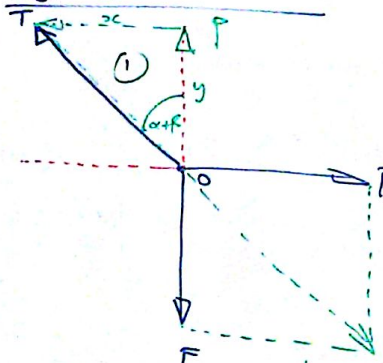
$\therefore \tan(\alpha+\beta) = \frac{P}{F}$

$\therefore P = F \tan(\alpha+\beta)$

$P = 4000 \cdot \tan(11.31 + 4.55)$



If all forces are in balance



$\Rightarrow$ in x-direction

$P - x = 0$

$P = x$

in y-Direction

$F - y = 0$

$\therefore F = y$

From above

$\mu = \tan\alpha$

$0.2 = \tan\alpha$

$\therefore \alpha = \tan^{-1}(0.2)$

$\alpha = 11.31°$.

Scanned by CamScanner

$\therefore T = P.r$

$T = (1120).(6 \times 10^{-3})$

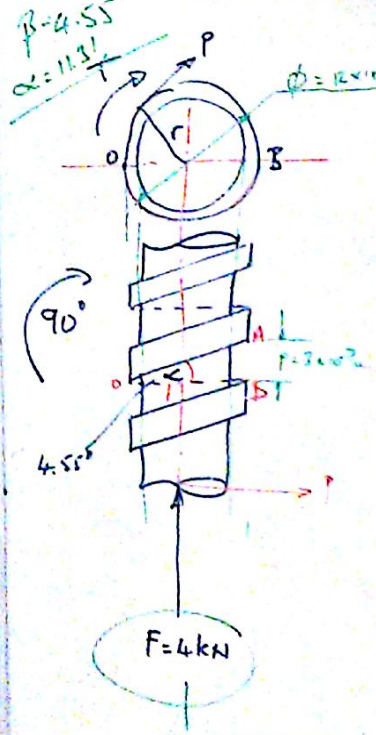
$\boxed{T = 6.72\ N.m.}$

Torque to be applied to due to force 4 kN.

Scanned by CamScanner

$\beta = 4.55$

$\alpha = 11.31$



Const F $\Rightarrow$ P

$\mu = 0.2$

Friction Ang. = β say.

From Δ①

$\sin(\alpha+\beta) = \frac{x}{T}$

$\cos(\alpha+\beta) = \frac{y}{T}$

$\tan(\alpha+\beta) = \frac{\sin(\alpha+\beta)}{\cos(\alpha+\beta)}$

$= \frac{(x/T)}{(y/T)} = \frac{x}{T} \cdot \frac{T}{y}$

$\boxed{\tan(\alpha+\beta) = \frac{x}{y}}$ ✓

$\therefore \tan(\alpha+\beta) = \frac{P}{F}$

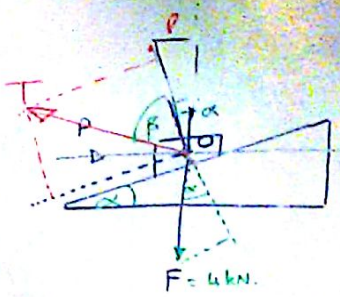
$\therefore P = F \tan(\alpha+\beta)$

$P = 4000 \cdot \tan(11.31 + 4.55)$

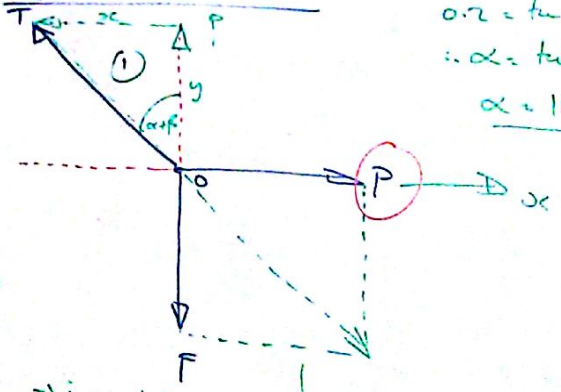
$P = 4000 \tan(15.86)$

$\therefore P = 4000 (0.28)$

$P = 1120\,N$



3 forces are in balance



$\Rightarrow$ in x-direction

$P - x = 0$

$(P = x)$

in y-direction

$F - y = 0$

$(F = y)$

From above

$\mu = \tan\alpha$

$0.2 = \tan\alpha$

$\therefore \alpha = \tan^{-1}(0.2)$

$\alpha = 11.31°$

Scanned by CamScanner